Small-scale Forests Economics. Management and Policy, 4(3): 269-292, 2005

Causes of Illegal Logging in Central and Eastern Europe

Laura Bouriaud
Forestry Faculty
University 'Stefan cel Mare' Suceava
9, str. Universitatii, 720225, Suceava, Romania

A study has been undertaken to investigate the extent to which poverty is a determinant (final cause) of illegal logging, and to identify valid short-term policy variables for the control of illegal logging in Central and Eastern European (CEE) countries. The study identifies the main features of illegal logging and forest-related and rural-related conditions in the CEE region, and uses principal components analysis and cluster analysis to obtain a typology of the CEE region according to the above conditions. Regional differences within Lithuania and Romania are specifically examined. The analysis reveals that the occurrence of illegal logging is explained by poverty, but also by the reform on land ownership and by weak law enforcement. Implications of these results for policies to cope with the illegal logging phenomenon are discussed.

Keywords: timber robbery, unauthorised logging, rural poverty, property rights, forest policy

INTRODUCTION

There is a growing concern in Europe about illegal logging and related trade threatening good forestry governance (Brack *et al*. 2002, Collective 2002, European Commission 2003, UNECE/FAO 2004b). The legality of cuttings has become a key issue for sustainable forest management, particularly in the Baltic area and in Balkans (Ahas 1998, 2001, Pettenella 1999, Lloyd and Lindahl 2000, ACER 2001, Bouriaud 2001, WWF Latvia 2003). In these regions, the volume of uncontrolled cutting increased substantially after the restitution of forests to their former owners. Notably, the intensity of illegal logging was higher in private forest estates and in forests held by entities other than the state.

Estimates of the share of the illegally cut volume in the total removals of the country vary greatly according to the information source. On the one hand, governmental sources provide official data on the level of illegal logging; on the other hand, studies made by NGOs and international organisations provide expert-based estimates and interpretations of the illegal logging phenomena. Bouriaud and Niskanen (2003) provided a short review on what illegal logging means by definition and presented data about the importance of illegal logging in selected CEE countries. Their results indicate that the officially recorded volume of illegally removed timber generally varies from 1% to 6% of the total volume harvested.

However, in the case of private forests, illegal logging may reach up to 10% of the total harvest.

Although knowing the root causes are important for formulating policies against illegal logging, there is a lack of empirical studies on causality relationship of illegal logging. Some widely accepted assumptions are that the causes of illegal logging are found among institutional or socio-economic features, such as incompetent and inconsistent government policies, political power of timber companies, over-capacity of the timber industry, failures of law, weak law enforcement, unclear and unstable ownership rights, insufficient knowledge and inadequate knowledge management, lack of transparency, insufficient budgetary resources, and corruption among forest staff (Ahas 1998, Callister 1999, Morozov 2000, Contreras-Hermosilla 2002). In the illegal logging literature, the research undertaken by the Albanian Centre for Economic Research (ACER 2001) represents an exception in terms of the scale of empirical investigations. The ACER research used systematic surveys (forest-plot related assessment, checkpoint monitoring, and household samples) to investigate commercial-interest-driven illegal logging, and poverty-driven illegal logging.

In parallel, the political process becomes more interested in having better understanding of causality relationships in the illegal logging issue (UNECE/FAO 2003, European Commission 2003, MCPFE 2003). In a joint UNECE/FAO seminar (UNECE/FAO 2004b, Pepke 2004), representatives from 33 countries of Europe and North America met in Geneva in 2004 to discuss the extent and causes of illegal logging and trade of illegally derived forest products. The workshop conclusions distinguished between two broad types of illegal logging in the CEE region (UNECE/FAO 2004b):

- where the rural population is driven by poverty to over-exploit local forests, publicly or privately owned, in an unregulated fashion, to satisfy its own urgent needs, mostly for fuel; and
- where criminals, whether individuals or companies, bribing the forest administration or acting by deception or force, deliberately over-harvest, capitalise on gaps in legislation and harvest wood in contradiction to law, for sale to domestic or foreign markets.

Illegal logging is only a part of illegal activities in the forest sector, which can also include illegal timber processing and illegal trade of wood and wood products (Bouriaud and Niskanen 2003). This study is concerned only with illegal logging, defined as logging activity violating the prescriptions of the law in timber-producer countries (FLEGT 2002). Illegal logging is classified to include two categories of law infringement, appearing also in the national statistical records, i.e. ‘timber robbery’ (timber theft, stolen timber) and ‘unauthorised logging’.

Timber theft is a breach of the property relationship and is punished as a *criminal offence*. Unauthorised logging includes logging without a felling licence, logging against or above the prescriptions of the forest management plan, and logging in the area were cuttings are prohibited. Unauthorised logging is sanctioned as a *contravention* which implies administrative punishment. In some countries (including Lithuania and Romania), unauthorised logging is recorded as a criminal offence when the timber volume concerned is above a specific threshold.

The main objective of the study reported here is to find empirical evidence on the causes of illegal logging. The paper first identifies the main features of illegal logging, and forest-related and rural-related conditions in the CEE region, and applies principal component analysis and cluster analysis to obtain a typology for the CEE region according to the above factors. Then, regional differences in illegal logging in Lithuania and Romania are examined. Finally, the implications of the research findings are discussed in the context of present policies for law enforcement and forestry governance.

ILLEGAL LOGGING AND ITS GENERAL CONTEXT IN THE CEE REGION

Basic Facts of CEE Countries

All Central and Eastern European countries have a gross domestic product per capita far below those realised in Western economies (Eurostat 2004a). For example, the sum of the gross domestic product realised in 2000 by 10 CEE countries was less than the gross domestic product of The Netherlands alone; in 2004, the sum of 10 CEE countries GDP increased to slightly above the GDP of The Netherlands. Amongst the 55 regions (a region groups several counties) of the CEE area, 50 have a regional gross domestic product representing only 75% of the EU average, CEE countries included (Eurostat 2004b). Slovenia, Estonia and Latvia are among the most forested countries. Forests are an important resource for rural areas in Estonia, Latvia, Lithuania and Slovenia as indicated by timber volume harvested per rural inhabitant (Table 1).

Regarding the institutional context (Table 2), the corruption index indicates that Estonia, Hungary and Slovenia have 'cleaner' institutions (less affected by corruption) compared with Albania, Moldova and Romania (Transparency International 2003). The illegal logging share in the total removals in the countries selected for the present study (official estimate) ranges between 0.5% and 5%, with the exception of Albania, where it was 40% in 2000 and 33% in 2001. Public ownership of forests dominates, with the exception of Estonia, Slovakia and Slovenia. At the end of year 2003, important forest areas were undergoing clarification of ownership in Bulgaria, Estonia, Hungary, Lithuania and Slovakia, in that the privatisation and restitution of forests to their former owners were in progress.

Main Features of Illegal Logging in Baltic Countries and in Romania

According to the official records in Romania and the Baltic countries, illegal harvesting represents less than 5% of the total harvested volume. In the year 2003, the volume of illegal logging was about 103,000 m^3 in Latvia, 112,000 m^3 in Estonia and 40,000 m^3 in Lithuania (UNECE/FAO 2004b). In the Romanian case, the estimate of about 100,000 m^3 per year (UNECE/FAO 2004b, Maftei 2005) applies only to public forests (about two thirds of the forest estate). Regarding the illegal logging in private forests, the Romanian figures available, of 55,805 m^3 in 2001 and 60,662 m^3 in 2002 respectively (MAAP 2003), suggest that the total illegal logging in the country is at least 50% to 70% higher than illustrated in Figure 1.

Table 1. GDP and forest area and harvest levels in CEE countries

Country	GDP per capita, US$, 2003	Agricult contrib. GDP 2003, (%)	Forestry contrib. to GDP(%) [a]	Forest Cover, 2000 (%)	Annual change of forest cover, 1990-2000 (%)	Share of rural population 2003 (%),	Forest per rural inhabitant 2003 (ha)	Harvest per inhabitant 2003 (m^3)	Harvest per rural inhabitant 2003 (m^3)
Albania	1,933	25	0.5	36	-0.8	56	0.60	0.093	0.167
Byelorussia	1,770	10	3	45	3.2	29	3.23	0.763	2.632
Bulgaria	2,539	12	0.5	33	0.03	30	1.70	0.618	2.059
Czech Rep.	8,794	3	1	34	0	26	1.00	1.484	5.708
Estonia	6,713	4	4.2	49	0.58	31	5.37	7.539	24.319
Hungary	8,169	4.5	1	20	1.33	35	0.54	0.571	1.632
Latvia	4,771	5	10	47	-1.19	34	3.70	5.565	16.367
Lithuania	5,274	7	2.3	32	-0.37	33	1.82	1.817	5.505
Moldova	463	23	0.3	10	0	54	0.17	0.013	0.025
Poland	5,487	3	2.3	30	0.33	38	0.63	0.755	1.987
Romania	2,619	13	2.4	28	-0.05	45	0.65	0.642	1.427
Slovakia	6,033	4	0.47	45	-1.18	43	0.83	1.179	2.742
Slovenia	13,909	2.1	1	55	0.7	49	1.18	1.299	2.651
Ukraine	1,024	14	0.54	17	0.1	33	0.68	0.273	0.826

a. Forestry contribution to the GDP represents the share of value added by forestry and logging activities and wood processing industries, excluding furniture, in the country GDP. Data on forestry contribution to the GDP are for the year 2001 for Byelorussia, 2002 for Poland and Slovakia, and 2003 for the other countries. Forestry contribution in the Albania GDP in 2003 is an estimate made by the author.

Sources: TBFRA (2000); World Bank (2002; 2005); Eurostat (2004a); UNECE/FAO (2004a; 2004b); UNFPA (2004); Chobanova (2004); Mészáros *et al.* (2004); Jansky *et al.* (2004); Zając *et al.* (2004); Trejbalová and Vančura (2004); UNECE (2005); Institute of Statistics, Albania; Ministry of Statistics and Analysis, Byelorussia; National Statistical Institute of Republic of Bulgaria; Ministry of the Agriculture of the Czech Republic; Czech Statistical Office; Statistical office of Estonia; Ministry of the Environment Estonia; Hungarian Central Statistical Office; Ministry of Agriculture, Latvia; Central statistical Bureau of Latvia; Department of Statistics, Lithuania; Departmentul de Statistica si Sociologie al Republicii Moldova; Centrum Informacyjne Lasów Państwowych; Central Statistical Office of Poland; Institutul National de Statistica; Statistical Office of the Slovak Republic; Statistical Office of the Republic of Slovenia; State Statistics Committee of Ukraine.

Table 2. Institutional context of forest development in CEE countries

Country	Environ-mental sustainability index, 2005[a]	Corruption index[b], 2003	Public ownership 2003 (%)	Forest area without clear ownership, 2000 (%)	Forest area without clear ownership, 2003 (%)	Illegal logging in total harvested volume, 2000 (%)	Illegal logging in total harvested volume, 2003 (%)[c]
Albania	58.8	2.3	95	2	0	40	33
Byelorussia	52.8	4.1	100	0	0	1	0.1
Bulgaria	50.0	3.5	86	5	5	4	1
Czech Rep.	46.6	4.3	63	4	0	1	0,7
Estonia	58.2	5.7	47	30	25	5	0.8
Hungary	52.0	5.2	60	20	10	1	0.4
Latvia	60.4	3.4	57	10	0	2	1
Lithuania	58.9	4.1	50	36	19	0.5	0.7
Moldova	51.2	2.6	100	0	0	4	8.7
Poland	45.0	4.1	82	0	0	1	0.13
Romania	46.2	2.9	88	1	1	1	1
Slovakia	52.8	3.5	42	25	7.3	1	1.4
Slovenia	57.5	5.5	15	0	0	4	1.8
Ukraine	44.7	1.5	99	0	0	1	1

a. The Environmental Sustainability Index (ESI), calculated by CIESIN (2005) benchmarks the ability of nations to protect the environment. It is an overall index integrating 76 data sets – tracking natural resource endowments, past and present pollution levels, environmental management efforts, and the society's capacity to improve its environmental performance – into 21 indicators of environmental sustainability. Higher ESI scores suggest better environmental stewardship. The four highest-ranking countries are Finland, Norway, Uruguay and Sweden, for which ESI scores vary between 71.7 and 75.1.

b. Corruption index relates to perceptions of the degree of corruption as seen by business people and risk analysts, and ranges between 0 (highly corrupt) and 10 (highly clean).

c. Data for the year 2001 are for Albania, and for the year 2002 for Slovakia.

Sources: Pettenella (1999), TBFRA (2000), ACER (2001), Ahas (2001); Centre of Forest Protection and Silviculture Estonia (2001), Bouriaud and Niskanen (2003), Centrum Informacyjne Lasów Państwowych (2003), INDUFOR/EFI (2003), Transparency International (2003), State Forest Survey Service Lithuania (2004), Inspectoratul Ecologic de Stat, Moldova; National Forest Administration, Romania (2004), UNECE/FAO (2004b), CIESIN (2005), State Forest Service, Latvia (2005).

Assessments by expert-based panels suggest that in Latvia and Estonia the volume illegally logged might be 50% to 100% higher than the volume officially recorded (Estonian Green Movement 2003, WWF 2003). The Estonian Green Movement has acknowledged that timber theft is 5% of the total volume of felled timber instead 1% as in official records, and the violation of felling regulations (unauthorised logging) may be 20% of total timber felled (Ahas 1998). The intensity of felling in private forests in Estonia increased progressively from 2.37 m^3/ha in 1995 to 4.34 m^3/ha in 2000 (Centre of Forest Protection and Silviculture Estonia 2001) or 13 m^3/ha according to other source (INDUFOR/EFI 2003), and it is almost twice that of felling in the state forests.

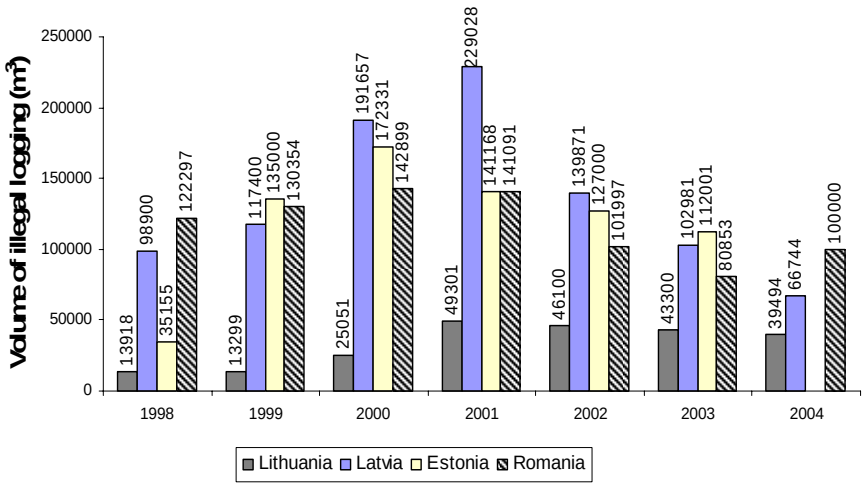


Figure 1. The evolution of illegal logging in the Baltic countries and Romania

Source: WWF (2003), National Forest Administration, Romania (2004), State Forest Survey Service Lithuania (2004), UNECE/FAO (2004b), Maftei (2005), State Forest Service, Latvia (2005). No data for Estonia are available for year 2004.

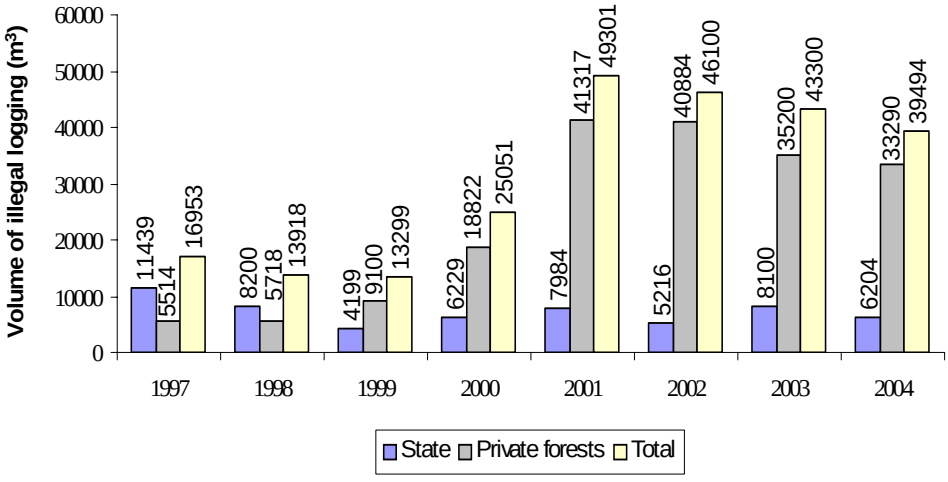


Figure 2. Volume of illegal logging in private and public forests in Lithuania

Source: WWF (2003), UNECE/FAO (2004b).

In Northern Romania, private owners acknowledged that, in the absence of a forest management plan, they harvest 3 or 4 m^3/ha/year instead of the legal quota that is 2 m^3/ha/year (Bouriaud 2001). In Latvia, the volume illegally cut in private forests

was up to 12 times as high as the volume illegally cut in state forests (WWF 2003, State Forest Service, Latvia 2005). For the four countries of Latvia, Lithuania, Estonia and Romania, the volume illegal logging progressively increased until the years 2000-2001, and sometimes increased spectacularly, as in the private forests in Lithuania (Figure 2). Since 2001, the total volume of illegal logging presents a slightly decreasing trend in Baltic countries, but not in Romania.

Substantial differences appear between countries when analysing the average volume stolen per theft. While this average for Romania is less than 3 m^3, in Lithuania it was 12 m^3 in 1999 and 10 m^3 in 2003. There is even a Lithuanian county where six cases of forest theft amounted to 145 m^3, or an average of 24 m^3 per theft. In the Romanian case, the highest average volume of timber stolen per case is 8.5 m^3. When the volume stolen per theft is significant, e.g. about one truck load or 10 to 20 m^3, commonsense suggests that the final destination of the wood will be the (black) market, whilst when the volume stolen is less than 3 m^3 it is more likely that this wood will be (self) consumed locally.

Considering the average volume of unauthorised logging, the differences are even higher. The average volume of unauthorised logging in Estonia in 1998 was 64 m^3, in Lithuania 12 m^3 (but 24 m^3 in 2003), and in Romania 0.6 m^3. The comparison with Romania is biased because of the Romanian definition of the unauthorised logging as logging illegally less than 2 m^3. Nevertheless, the difference between Lithuania and Estonia is substantial and may be explained by better timber trade facilities and opportunities in Estonia than Lithuania.

To conclude, the illegal logging in Baltic countries and Romania are characterised by:

1. higher volume than the official statistics indicate;
2. higher intensity in private forests than in state forests; and
3. a ‘small-scale’ oriented illegal logging in Romania compared to Baltic countries.

RESEARCH METHOD

If illegal logging is interpreted in terms of an overall purpose or design (teleological perspective), then institutional and socio-economic factors do not induce ‘illegal’ behaviour: they just create favourable conditions for those who consciously look to trespass the law. Therefore, these factors cannot be considered the final causes of the illegal logging, but only its circumstances, or the proximate causes. Rewording Bromley (2001), the *final causes* of illegal logging can only be determined by giving explicit recognition to the idea of intent. Thus the illegal logging has as final causes:

- rent seeking behaviour, in circumstances characterised by timber trade opportunities and weak law enforcement; and
- rural poverty, in circumstances of lack of forest resources in the area, weak law enforcement and a weak property rights system.

In the first case, criminals, individuals and companies act by deception or force to over-harvest deliberately and capitalise on gaps in legislation, while in the second

case the rural population over-exploits local forests, mainly due to the need for fuelwood (Pepke 2004).

This study focuses on rural poverty as a final cause of illegal logging. The research assumes that the influence of poverty on illegal logging depends on three circumstances:

1. *forest resource abundance in the region*. The local inhabitants need fuelwood and timber for rural buildings that in the CEE region they procure usually directly from forests located near to their villages. Of course, they can procure the necessary timber from forests located elsewhere: however, the price of timber procurement, including transport costs and, eventually, payment of bribes, will be higher in this case. The corollary is the smaller the forest area in the region, the greater will be the incidence of timber theft (reported as number of cases, or number of cases per forest surface area unit) (proposition P1);
2. *the forest ownership conditions*. The form of ownership characterises the access to the forest resource and the exclusivity of rights over forest utilisation. In some CEE countries, there is a weaker capacity to ensure exclusive access rights to the private forest resources than the public forest estate (Bouriaud 2001, 2002). Further, important forest areas have had unclear ownership over several years because of the continuing restitution and privatisation processes. The forest ownership conditions should influence the extent of illegal logging: the greater the private ownership area, or the area with unclear ownership, the greater the incidence of illegal logging (proposition P2); and
3. *law enforcement*. Enforcement of forest laws is considered equally well performed at a given time in all counties within a country, even if it may be weaker in the private forest estate than in the public one (proposition P3). Due to the context of institutional reform of the CEE forest sector, the capacity of law enforcement may vary greatly from year to year (e.g. in terms of staff, financial resources and institutional competences). For this reason, the analysis is not based on time series data on illegal logging.

While comparable data exist for forest resource abundance, the form of ownership and the illegal logging through surface and volume-related indicators, it is more difficult to find homogenous regional variables for assessing the poverty level. A direct monetary measure of utility (e.g. household expenditure) is commonly used for that purpose, but these data are rarely available at the county level in the CEE region. However, studies on poverty (e.g. Grootaert and Braithwaite 1998, IFAD 2002) showed that in the CEE region poverty is highly correlated with the individuals' situation in the formal labour market, which can be classified as employed, unemployed (but continuing to benefit from the unemployment insurance) or unpaid unemployed (without any financial support as unemployment insurance or security support from the state). Thus the choice was made to use the indicators 'total unemployed people' and 'unpaid employment' as variables describing regional poverty, and to include in the analysis the variables 'employment in agriculture' and 'employment in forestry'.

The differences between countries and regional differences within countries have been analysed using principal component analysis (PCA). This technique offers the

possibility to compare characteristics of various individual units (e.g. countries or counties) simultaneously, to identify alike groups and to reveal the factors according to which the individuals are best differentiated (Benzécri 1980, Legendre and Legendre 1998). The principal components are linear combinations of weighted observed variables. They are chosen to be orthogonal (i.e. independent or uncorrelated) and to maximise the proportion of total variance of the data they include. The successive principal components correspond to progressively smaller fractions of the total variance.

A hierarchical cluster analysis was performed to classify the countries into homogeneous groups with respect to the principal components. Cluster analysis is a technique used for combining observations into groups or clusters such that each group is homogenous with respect to particular characteristics, and each group should be different from other groups with respect to the same characteristics (Sharma 1996). The dissimilarity between countries was measured as Euclidean distance and the hierarchy computed according to Ward's minimum variance method.

RESEARCH FINDINGS

Typology of the CEE Region using Principal Component Analysis

The PCA was computed on three categories of variables: (1) variables describing the forest resource: forest cover, change of forest cover in the decade 1990-2000, forest area per inhabitant and per rural inhabitant, forestry and wood processing industry contribution in the GDP, annual harvested volume per inhabitant and per rural inhabitant, share of exported volumes of sawn wood and roundwood in the total sawn wood and roundwood production in the country; (2) variables describing the rural conditions: share of rural population in the country, density of rural population, number of people employed in agriculture and in forestry, agriculture contribution in the GDP; and (3) variables describing the institutional context or forest development and the illegal logging: sustainability index, corruption index, forest area with unclear ownership, share of illegal logging in the annual total harvested volume, structure of forest ownership in the country. The calculations were made on two data sets separately, one with figures for the year 2000, and the other with figures for the year 2003.

Computed correlation coefficients (Table 3) reveal a significant relationship between the share of agriculture in the GDP and the share of illegal logging in the total harvested volume. The more important agriculture is in the country, the greater is the volume of timber illegally cut. By the same token, the more important the share of rural population in the country is, the greater the part of illegal logging is in the total harvest in the country. Significant correlation was also found between GDP and the structure of ownership: a greater share of state forest ownership is to be found in poorer countries than in richer ones. The environmental sustainability index also tends to be lower in those countries with a high proportion of state ownership of forests. Finally, in the 2000 dataset the share of forest area with unclear ownership is correlated with the share of roundwood export of total roundwood production, which signifies that the countries with important areas in clarification of ownership were

also net exporters of roundwood. The correlation is not significant in data for the year 2003.

Table 3. Correlation coefficients between year 2000 and 2003 forest-related variables datasets

Correlated variable	2000		2003	
	Correlation coefficient (r)	Significance level (p)	Correlation coefficient (r)	Significance level (p)
Share of agriculture in GDP and the share of illegal logging	0.88	p< 0.0001	0.73	p = 0.003
Share of rural population and illegal logging	0.67	p = 0.01	0.66	p = 0.01
GDP per inhabitant and share of private forest ownership	0.88	p< 0.0001	0.86	p< 0.0001
GDP per inhabitant and share of state forest ownership	-0.81	p = 0.0004	-0.81	p = 0.0005
Environmental sustainability index and the share of state ownership	-0.86	p< 0.0001	-0.56	p = 0.04
Forest area with unclear ownership and the roundwood export	0.82	p = 0.0003	0.49	p = 0.07

From the 13 components computed by the PCA on the 2003 dataset, the first three components explain 76% of the total variance: the first component represents 42% of total variance, the second 18% and the third 14%. On the first principal component (Axis 1), Albania, Moldova and Ukraine are opposed to Estonia, Slovenia and Latvia (Figure 3). The countries are discriminated by the variables 'harvesting per rural inhabitant', and, to a smaller extent, 'share of state ownership', 'share of private ownership' and 'forest cover'. As a consequence, the first PCA component is identified as being 'the forest resource scarcity in rural area'. The second component in the same figure (Axis 2, Figure 3) is 'the density of rural population'.

The third component (Axis 3, Figure 4) is 'the sustainability of forest management'. The component is defined mainly by the variables 'illegal logging', and 'change in forest cover', and, to a lesser extent, by the variables 'forests share in GDP', 'agriculture share in GDP' and 'sawn wood exports'.

PCA reveals two important points. Firstly, the typology derived distinguishes between countries with scarce or abundant forest resource availability per rural inhabitant. Within these two groups, there is the group of countries with higher density of rural population, e.g. Albania, Slovenia, Moldova, and Czech Republic, and the group of countries with lower density of rural population, e.g. Estonia, Latvia, Ukraine (Figure 3). Also, there is the group of countries with sustainable forest management, e.g. Hungary, Byelorussia, and Poland, and those countries with less sustainable forest management, e.g. Albania, Latvia, and Estonia (Figure 4).

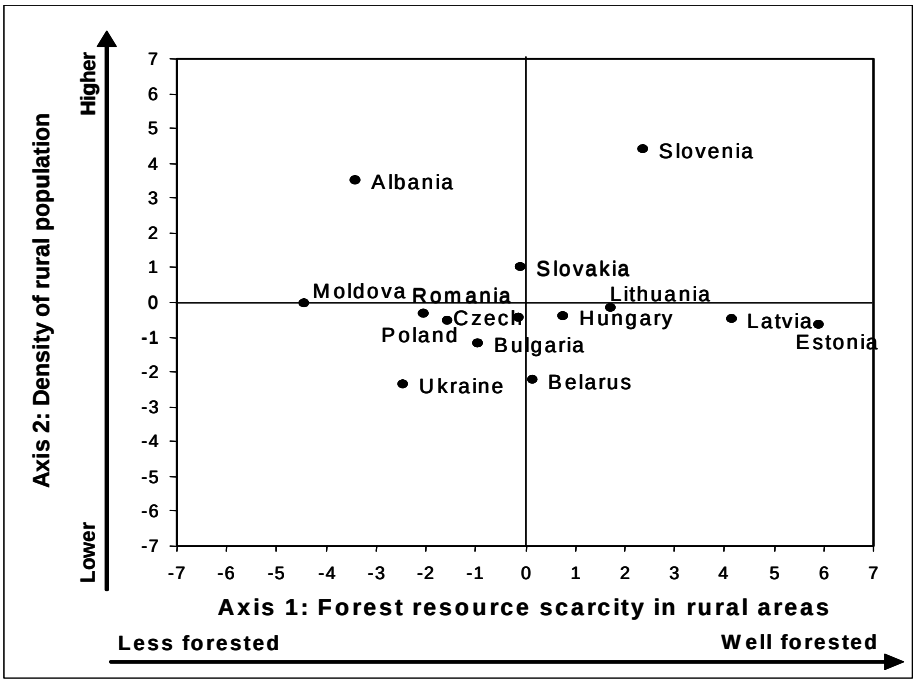


Figure 3. The localisation of countries along the first and second component (2003 dataset)

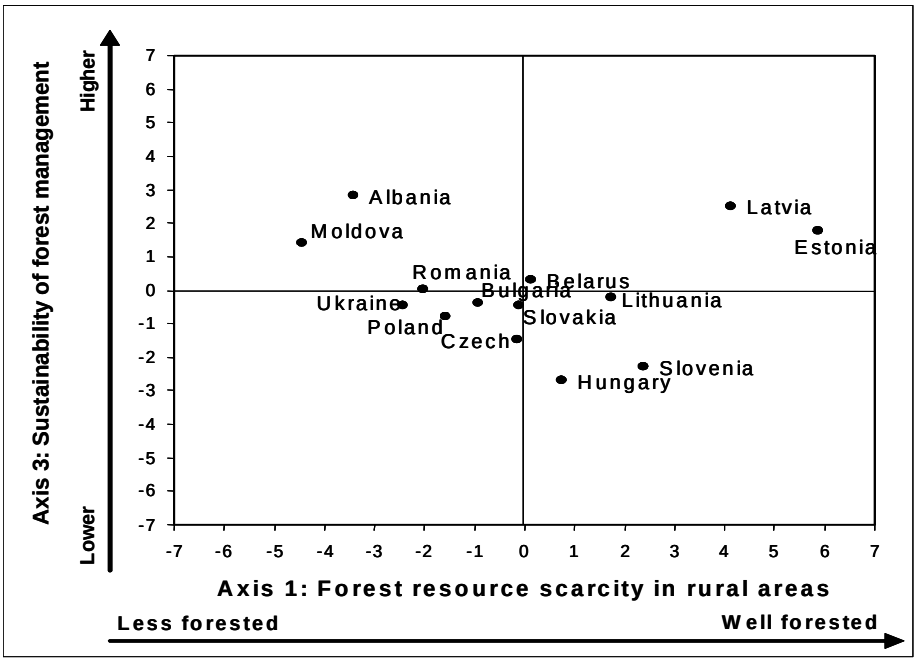


Figure 4. The localisation of countries along the first and third component (2003 dataset)

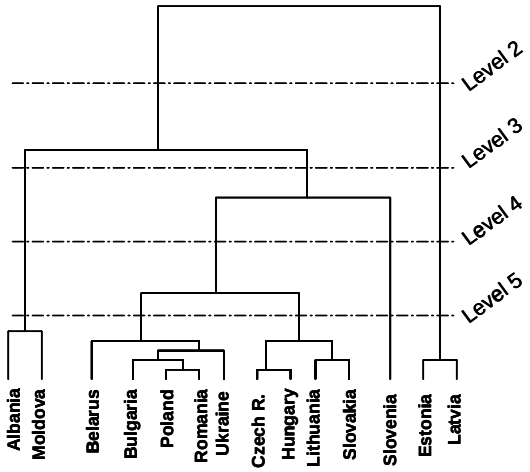
Secondly, Romania and Lithuania are located around the gravity centre defined by the intersection of components. They are hence more representative of the CEE average countries. Romania and Lithuania are also projected within the same group and have highly similar component scores. Therefore, a deeper analysis of the Lithuania and Romania country cases is allowed by their similar position in terms of the PCA components.

Finally, the PCA calculations done separately for the 2000 and 2003 datasets did not reveal significant differences between results. The explanation is that the forest resource scarcity and the density of rural population, as main variables discriminating the countries in both years, did not vary significantly within the three year period.

The conclusions from the PCA are confirmed by cluster analysis. The dendrogram presented in Figure 5 indicates that primarily Estonia and Latvia are clearly diverging from the other countries, because they are distinguished at the first step of the clustering. Next, Albania and Moldova are gathered, and Slovenia is put apart. Finally, two more sub-groups may be identified, leading to the splitting of the 14 countries into five groups:

1. Albania and Moldova, as poor and mostly rural countries, with the lowest level of timber harvested per rural inhabitant, with a high share of illegal logging and a high share of agriculture input in the GDP (more than 20%).
2. Belarus, Bulgaria, Poland, Romania and Ukraine (the Eastern Europe group) which have in common the prevalence of state forest ownership and the relative high importance of agriculture in GDP (more than 10%, except Poland).
3. Czech Republic, Hungary, Lithuania and Slovakia (the Central Europe group), richer than the countries from the previous group, with a share of state ownership of the forest area at 40% to 60%, and agriculture input limited at 3 and 7% of the GDP.
4. Slovenia, as a country cumulating several particularities (the richest country amongst those selected, the most forested, with the highest density of rural population and the highest share of private forests).
5. Estonia and Latvia (the Baltic group), highly forested, with highest volumes of harvested timber per rural inhabitant.

To summarise, the variables discriminating the countries are, respectively, the availability of forest resource per rural inhabitant, the density of rural population, the agriculture input in the GDP, and the structure of ownership on forests.



Country	Level 2	Level 3	Level 4	Level 5
Albania	**2**	**2**	**2**	**2**
Moldova	**2**	**2**	**2**	**2**
Belarus	**2**	**3**	**4**	**4**
Bulgaria	**2**	**3**	**4**	**4**
Poland	**2**	**3**	**4**	**4**
Romania	**2**	**3**	**4**	**4**
Ukraine	**2**	**3**	**4**	**4**
Czech R.	**2**	**3**	**4**	**5**
Hungary	**2**	**3**	**4**	**5**
Lithuania	**2**	**3**	**4**	**5**
Slovakia	**2**	**3**	**2**	**5**
Slovenia	**2**	**3**	**3**	**3**
Estonia	**1**	**1**	**1**	**1**
Latvia	**1**	**1**	**1**	**1**

Figure 5. Cluster tree of the countries (2003 dataset) computed on the three principal components (left); clusters distinguished according to the position within the tree (right)

Results of the Statistical Analysis in the Lithuanian and Romanian Cases

Lithuania and Romania were chosen for a deeper analysis not only because they realised a similar score component in the PCA, but also because the data on illegal logging were available for the year 2000 at the level of counties.

The analysis of the Lithuanian case has been undertaken on 10 counties for 14 variables, belonging to three categories:

- illegal logging related: number of cases and volume of unauthorised logging, in all forests and in private forests; volume and the number of cases of timber theft, in public and in private forest;
- population and regional welfare related: share of rural population, unemployment in the county, average gross monthly earning per employee in the county; and
- forest resource and ownership related: share of private forests, area and share of forests undergoing clarification of property rights, forest area per county.

The analysis highlights the relationship between the area under the clarification of ownership and the number of cases of unauthorised logging in both public and private forests ($r = 0.76$, $p = 0.01$), and between the forest area under the clarification of ownership and the number of cases of unauthorised logging in private forests ($r = 0.64$, $p = 0.04$). The implication of these results is that the greater the forest area of unclear ownership in the county, the higher is the incidence of unauthorised logging. The number of cases of unauthorised logging and the number of cases of timber theft are correlated with the total forest area in the country ($r = 0.86$, $p = 0.0013$, and $r = 0.80$, $p = 0.005$), respectively.

For Romania, the analysis (25 cases and 25 variables) was undertaken at the level of forest enterprises, which are the grouping of two or three counties. The variables considered were:

- illegal logging related, and criminality related: number of cases and volume of unauthorised logging; number of cases and volume of timber robbery; number of persons punished for timber robbery; criminality rate (number of persons punished per 100,000 inhabitants); forest criminality rate (number of persons punished for timber robbery per 100,000 inhabitants); share of forest criminality in general criminality;
- population and regional welfare related: total population; rural population; number unemployed; unpaid unemployed people (people unemployed who do not receive any security support from the state); total number of employed people; employees in agriculture; employees in forestry; and
- forest resource and ownership related: area of private forests; area of forests managed by National Forest Administration; total volume cut; area of forest being in poor condition; area of forest claimed back by the former owners in the restitution process.

The computed correlations highlight first the relationship between poverty and criminality (Table 4). 'Criminality' is correlated with the rural population, unemployed people and employment in agriculture – reflecting that the population occupied in agriculture represents one of the lowest income groups of the Romanian population.

Secondly, the analysis reveals the 'rural' dimension of the illegal logging phenomenon. The higher the number of persons employed in agriculture, or the share of rural population, the higher the number of illegal logging cases and the number of persons punished for timber theft. To illustrate with an example, in the county Bistrita, with the second highest share of rural population in Romania (63%), the number of persons punished for timber theft accounts for 43% of total county criminality, and in three others (Targoviste, Miercurea Ciuc and Baia Mare) timber theft represents 11% to 16% of the total recorded criminality in the county.

Thirdly, the relationship between poverty and illegal logging is evidenced by the correlations found between the number of cases of unauthorised logging and the number of unemployed people ($r = 0.64$, $p<0.001$) on one hand, and the number of cases of unauthorised logging and the number of unpaid unemployed people ($r = 0.53$, $p<0.05$) on the other hand. In the Romanian system of records, the unauthorised logging is rather the act of individuals than of firms: each person who cuts without a permit less than 2 m^3 of timber will be punished for forest contravention and the timber will be recorded as 'unauthorised logging'. Therefore, the above correlations fully reflect the influence of poverty on illegal logging: the greater the number of unemployed persons and of persons without any security support from the state, the greater the number of cases of unauthorised logging.

Table 4. Correlations coefficients in the Romanian case

	Correlated variable	Correlation coefficient (r)	Significance level (p)
1	Unauthorised logging, number of cases and area of private forests	0.61	p = 0.001
2	Unauthorised logging, number of cases, and area of degraded forests	0.56	p = 0.003
3	Unauthorised logging, number of cases, and the number of rural inhabitants	0.75	p< 0.0001
4	Unauthorised logging, number of cases, and unemployed people	0.64	p = 0.0005
5	Unauthorised logging, number of cases, and number of employees in agriculture	0.71	p< 0.0001
6	Unauthorised logging, number of cases, and unpaid unemployment	0.53	p = 0.006
7	Unauthorised logging, volume, and sawnwood production	0.71	p<0.0001
8	Stolen timber, volume, and sawnwood production	0.71	p<0.0001
9	Stolen timber, volume, and total annual harvest	0.58	p = 0.002
10	Number of 'criminals' (persons punished for crimes) and rural inhabitants	0.86	p<0.0001
11	Number of 'criminals' (persons punished for crimes) and unemployed persons	0.80	p<0.0001
12	Number of 'criminals' and persons employed in agriculture	0.90	p<0.0001
13	Number of 'forest criminals' (persons punished for forest crimes) and rural inhabitants	0.53	p = 0.007
14	Number of unpaid persons, and the employment in agriculture	0.63	p = 0.0006
15	Number of unpaid persons, and the sawnwood production	0.62	p = 0.0008

Finally, a high positive correlation was found between the volume of illegal logging (unauthorised logging and timber theft) and sawnwood production ($r = 0.71$, $p<0.001$). This correlation, together with the similar correlation found in the Lithuanian case between the number of cases of illegal logging (unauthorised logging and timber theft) and the area of forests, suggests that that the incidence of illegal logging is directly proportional to the forest resources existing in the area. Thus, the higher the volume harvested (Romanian case) or the area of the forests (Lithuanian case) in a county, the higher is the number of cases of illegal logging. Proposition P1, stating that the less forested the area, the greater the incidence of timber theft, is therefore confirmed.

Unlike the Lithuanian case, the analysis does not reveal whether the land reform in Romania influences illegal logging. Instead, the number of unauthorised logging cases appears to be correlated with the area of private forests.

SUMMARY OF RESEARCH FINDINGS

Rural Poverty as Final Cause of Illegal Logging

Forest resource scarcity in rural areas and density of rural population are the first two components discriminating and grouping the selected countries of the CEE region. In other words, 'rural' socio-economic features and the endowment in forest resources matter when analysing differences between the countries from Central and

Eastern Europe. Illegal logging comes only in the third rank to explain differences between countries, and to a small extent (14% of the variance). The strong relationship between the share of agriculture in the GDP and the share of illegal logging in total harvested volume confirms the role of forests as one of the primary scarce resources in rural areas in the CEE region.

The PCA reveals that Romania and Lithuania are representative of the CEE average countries and that their similar component scores allow comparison of results in analysing domestic regional differences. Romania and Lithuania have in common a relatively low level of illegal logging, mostly concentrated in private forests. The main difference between these two countries comes from the average volume of illegally logged timber which is lower in Romania than Lithuania. The role of poverty in illegal logging is confirmed in the Romanian case by the high correlations found between the unauthorised logging and the variables related to unemployment in rural areas.

Forest Ownership Conditions as a Circumstance of Illegal Logging

Due to modalities of the land ownership reform (INDUFOR/ECO 2001, Bouriaud 2002), the clarification of ownership in Baltic countries for important forest areas was pending for several consecutive years. In Lithuania, the share of forests with unclear ownership was constantly the highest among CEE countries and represented 38% of the total forestland in 1998, 22% in 2003, and 19% at the beginning of the year 2004. The analysis shows that the greater the area of unclear ownership, the higher the incidence of the illegal logging. Despite the fact that the respective area was monitored by the national forest administration, it seems that the 'temporary nobody's land' situation was perceived as an opportunity to increase the harvested volume above the legal prescriptions or to harvest in breach of law.

In the Romanian case, the incidence of unauthorised logging is directly correlated with the area of private forests. When the forest area was transferred to the forest owners, they did not have the means to avoid timber theft or to control the volumes cut from their forests. Local analysis showed that private owners feel threatened by timber robbery (Bouriaud 2001, 2002). Timber theft menace leads to a 'prisoner's dilemma' situation: 'if I do not cut my timber, then others will steal it', in which the private owners react by cutting higher volumes than allowed. In response to the intensity of illegal logging in private forests, the Romanian and Latvian forest laws created the legal presumption of owner's culpability. Regardless of who really made the illegal cut, the owner is liable under law. The rule was contested as anti-constitutional, but was confirmed by several decisions of the Romanian Constitutional Court.

Law Enforcement as a Circumstance of Illegal Logging

Before the separation of the management functions and the control of law implementation functions in Romania, the monitoring of law compliance was a responsibility of the national forest administration (NFA), the manager of public forests. However, due to the sensitivity of the restitution process, or the restrictions in the institution budget, or to the distrust of private owners for the NFA, the NFA officers tended to reduce their intervention in the non-state forests (Bouriaud 2002, WWF 2003). Proper structures for law enforcement in forestry, namely the Forest Inspectorates and environmental guards, come into being in Baltic countries and

Romania only a decade after the commencement of ownership reform. Forest Inspectorates were established in Romania in the year 2001. It appears today that the main obstacle to law enforcement is no longer a lack of institutional and legislative framework, but rather a lack of staff and resources within the Forest Inspectorates. At present, the Forest Inspectorates, having the control of law implementation in all forests and performing also extension services for private forest owners, have fewer than 300 staff for a forested area of 6.3 M ha.

A second point on the law enforcement issue concerns the real capability of the juridical system to pursue illegal logging cases. The risk of being discovered and of being punished for timber theft or unauthorised logging is relatively low, particularly for small quantities of timber. This explains the high share of forest criminal offences with unknown offenders. For example, in 2000 the Estonian police department reported only 260 cases with identified offenders from 1242 registered cases of unauthorised logging and timber theft (Centre of Forest Protection and Silviculture, Estonia 2001). Similarly, the share of cases of illegal logging with identified and punished offenders in Romania has been below 30% throughout the last decade. It is notable that the number of forest contraventions and forest crimes in Romania was between 20,000 and 40,000 each year during the period 1992-2002. Considerable jurisdictional and law implementation effort is required to investigate and pursue the cases into the courts.

DISCUSSION

The role of rural poverty as final cause of illegal logging is apparent in the Romanian case. Proposition P2, that the forest ownership conditions create the circumstances for illegal logging, is verified in the Lithuanian case through the correlations between the illegal logging and the area with unclear ownership, and in the Romanian case through the correlation between unauthorised logging and the area of private forests. Proposition P1 is not verified: there is not greater intensity of timber theft or unauthorised logging in an area with less forest resources. Moreover, the fact that there is a direct correlation between the volume harvested (Romanian case) or the area of the forests (Lithuanian case) and the number of cases of illegal logging suggests possible further research questions. To what extent is illegal logging, as it is officially recorded, an endemic phenomenon, depending on the forest resource in the area, and determined ultimately by the real capacity of forest control bodies to monitor its occurrence?

It would be interesting to include in the analysis variables describing the capacity of law enforcement, e.g. the number of staff performing law enforcement tasks and the forest area under the responsibility of one forest guard or inspector, but such data were not available for the present study. In fact, data availability was the main limitation of the research method applied. The second limitation is represented by the data reliability. The official records considered in the study are

likely to underestimate the real volume illegally cut[1] and hence affect the typology of the countries from the CEE region (as far as the variable 'share of illegal logging in the total harvested volume' explains 14% of the variance in the PCA).

The causality relationship identified by statistical analysis converges with the expert-based assessment presented by WWF (2003) regarding the factors driving illegal logging in the Baltic region, including the difficult economic conditions of population living in the rural areas, the reform of the forest sector, the weak law enforcement, and the taxation system. In the Lithuanian case, the low level of state support over private forestry and, even worse, the debate about re-nationalisation of private forests and very strict forest harvesting regulations which are difficult for small-scale forest owners to fulfil, were identified as proximate causes of illegal logging.

In the context of the regional policies and initiatives for law enforcement and forestry governance (FLEGT Plan, MCPFE Work Programme) the present study highlights several key points:

1. Weaknesses exist in the system of recording and availability of general forest data, and particularly data on illegal logging. Inaccurate forest inventories, gaps in reporting and restricted public access to the forest databases combine to impede the monitoring of timber flows and the transparency of decisions on forest utilisation. A change in the communication policy and in the internal culture of the organisation is needed at the level of governmental forestry institutions.
2. The causality relationships identified by the study strongly support the idea of intersectoral coordination. The policies to fight illegal logging should be coordinated with the policies for rural development, for ownership reform, for combating corruption, and for taxation. As an example, better wood sorting when harvesting and the optimisation of timber sales procedures can substantially decrease the prices for fuelwood to rural inhabitants. Also, programmes for stimulating the use of bioenergy would improve the utilisation of forest resources.
3. In the medium term it is expected that the trend of economic growth will limit the extent of poverty-driven illegal logging, as will the progressive clarification

[1] Some examples of underestimation can be identified. A Romanian official acknowledged that nobody knows in fact how much is cut from private forests and estimates at around 4 M m^3 the volume of timber on the black market, i.e. 30% to 40% higher than the official volumes cut in the country (Ministry of Agriculture, Food and Forestry 2003). Field experimentation results in Slovenia suggests that the volume illegally cut in private forests in the period 1989-2003 was 47% higher than the amount shown in the official records (Veselič 2004). Latvian official reports acknowledged that when analysing the volumes of timber harvested (12.2 M m^3) and utilisation (13.46 M m^3) in 2002, about 1.2 M m^3 of unknown origin timber were identified in the Latvian market (Ministry of Agriculture, Republic of Latvia 2003). The Bulgarian report for the Geneva UNECE meeting on illegal logging also asserted that the real figures on illegal logging may be 10% to 25% of the total volume harvested in the country, compared with the 1% as officially recorded (Ivanov 2004).

of forest ownership. However, sustained effort is needed to support private forestry, starting with the development of suitable structures for the management of forests and provision of extension services. The law can be adapted to take greater account of the particularities of small-scale forestry and to avoid unauthorised logging as an effect of inappropriate rules. In this respect, the participation of the forest owners in the local formulation of policies is a desirable element of forestry governance and can provide a useful input for improving the rule of law in forestry.

ACKNOWLEDGMENTS

The author would like to express her gratitude to Anssi Niskanen for the support and assistance in an earlier version of this work, and to the researchers from the European Forest Institute for the interesting discussions had on the topic of illegal logging. The author also thanks Steve Harrison for his helpful comments and English corrections on drafts of the manuscript.

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